FLORISTIC AND GEOLOGIC ASPECTS OF INDIAN MIDDENS IN SALT MARSHES OF HANCOCK COUNTY, MISSISSIPPI

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ABSTRACT

Sixty-two species of flowering plants were collected from Indian middens (shell mounds) located in the salt marshes of Hancock Co., Miss. The diversity of the flora depended on the height of the midden above the marsh surface and increased with increased elevation. The largest midden (Cedar Island), with an elevation of about 1 m above the surface of the marsh (about 1.3 m above MLW) had the greatest diversity of species (47). Radiocarbon dating indicates that clam shells (*Rangia cuneata*) found on the surface of Cedar Island are over 2,600 years old. The geological history surrounding the establishment of the middens is discussed. Indicator plants for these Indian occupation sites 0.5 m or more above MLW are the calciphiles *Juniperus silicola, Erythrina herbacea*, and *Aesculus pavia.* These shell middens provide the only known habitat of *Sageretia minutiflora*, the first report of its occurrence in Mississippi.

INTRODUCTION

Salt marshes were apparently utilized by prehistoric humans for a considerable length of time. Human occupation sites in the coastal areas of Louisiana were established as early as 12,000 B.P. (Gagliano, 1963). Presently known cultural sites on the Mississippi Coast date back only to the last four millenia. The fact that these early people gathered shellfish as a food item from the estuarine waters and salt marshes is evident by the presence of numerous and extensive shell mounds, composed of the clam *Rangia cuneata.* Such shell deposits are "kitchen middens" (refuse heaps) at periodic Indian occupation sites, located close to the source of food. These mounds are relatively enduring features in the changing coastal environment and represent the only remaining local sites of floristic disturbance by prehistoric man, not obscured by natural processes or European man. Over the past several years we have located five previously unreported and undisturbed shell middens in the salt marshes of Hancock County, Mississippi. Although Brown (1936) described the vegetation of 16 mounds and middens in Plaquemines and St. Bernard Parishes (delta areas of the Mississippi River), Louisiana, on the shell middens we have visited, we noted an array of plant species previously unreported in Louisiana or Mississippi. The geological conditions that relate to the establishment of these middens are essential for the understanding of the flora's development. The present paper is the result of a combined effort to study these middens floristically and geologically.

The middens can only be reached by boat or pontooned helicopter. This isolation probably contributed to their preservation. A study of aerial photographs indicated the location of suspected shell middens and was followed by a general survey of the salt marsh area where five middens in the tidal marsh east of the Pearl River and south of Cadet Bayou were selected for study (Fig. 1). Floristic surveys were conducted seasonally in 1974, and periodically in 1975, 1976, and 1977. Geological information was taken from an ongoing, detailed geological study of the Mississippi coast including core drillings in the marshland and radiocarbon dating of the middens.

GEOLOGICAL FRAMEWORK

The geological evolution of southern Hancock County (Fig. 1) began after a long period during the Wisconsin glacial stage and the early Holocene epoch when the subject area was dry land. Transgressing mid-Holocene sea waters reached it at about 6,300–6,000 years ago. By about 4,000–3,500 years ago, all of the present marsh area was inundated and a low dune ridge (Magnolia Ridge) formed along this new shoreline. With the first arrival of sea waters, silty-muddy and marsh deposits characterized by *Ammotium-Haplophragmoides-Miliammina* agglutinate foraminifers, formed in the low salinity nearshore waters influenced by fresh waters from the Pearl River. Oyster reefs developed in more saline waters further seaward, while the central and southern-southeastern parts of the present marsh area were covered by the highest salinity waters. Open-Gulf nearshore-type, varied and rich foraminifer fauna (*Elphidium-Buliminella-Nonion-Ammonia*) thrived on the bottom sediments there (Fig. 2). The high energy conditions near the shore resulted in the development of sandy shoals and in the subsequent emergence of low (1.5–4.0 m), narrow, elongated barrier islands: Point Clear and Campbell Islands.

The sand for these developing islands was derived from the east along the Mississippi barrier island-shoal chain (via Cat Island—Square Handkerchief Shoal) and the Hancock barrier islands themselves become parts of another 50 km long barrier-shoal trend (Bayou Sauvage—Hancock County trend, Otvos 1973, Fig. 16) which extended deeply into the present New Orleans area. Growth of the large Mississippi River subdeltas (St. Bernard Parish) prevented further seaward progradation of Point Clear and Campbell Islands. This delta development south-southeast of the Hancock area eventually cut off the sand supply. It severely restricted open marine water influx and also reduced wave energies. The decreasing salinities south of the two

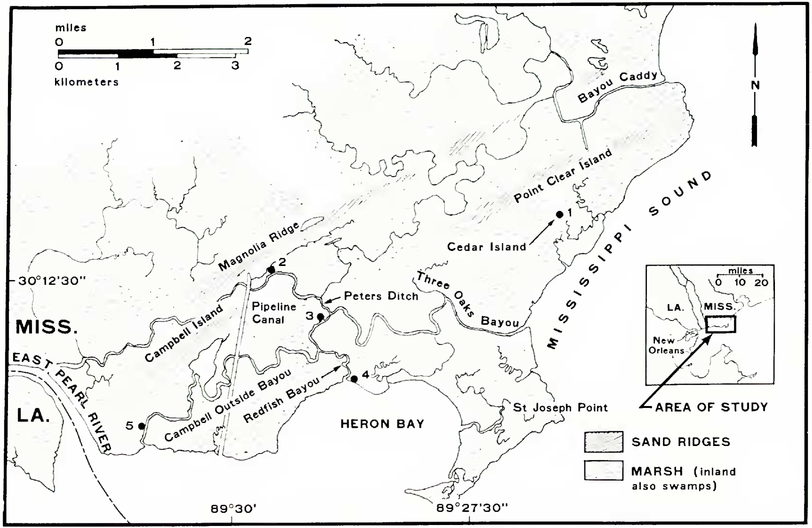


Figure 1. South Hancock County marshland. Numbers 1–5 refer to Indian midden locations, discussed in text.

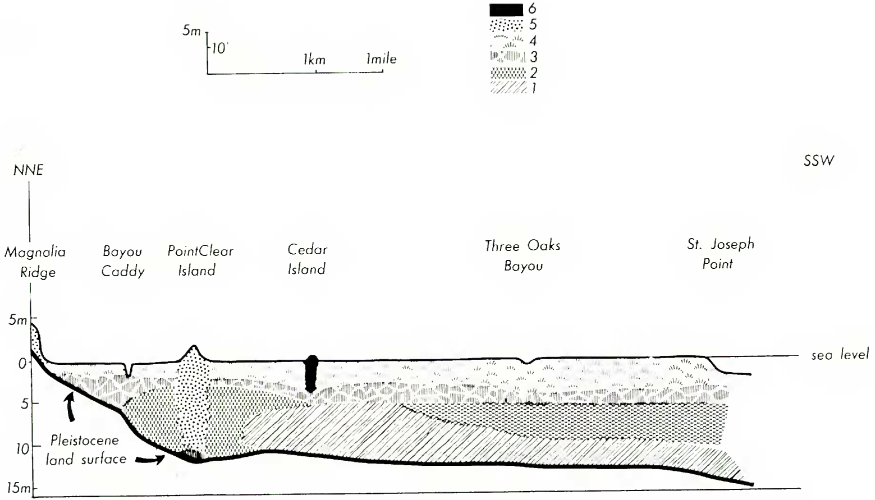
islands are reflected by the less varied *Ammonia-Elphidium-Nonion-Nonionella* fauna in the muddy, sandy-muddy nearshore deposits of the period. Immediately south of Campbell and Point Clear Islands, sediments, presumably mostly from the Pearl River, built the bottoms up to intertidal levels and marsh vegetation was established, protected by the Mississippi River subdeltas. At its peak of development, this marshland extended considerably beyond the present southern and eastern marsh shores.

At this stage, Indian refuse middens started to dot the banks of creeks in the newly established marshland. Shells of a very low salinity bivalve, the edible *Rangia cuneata* almost exclusively form the mounds. This is especially so, at the largest midden, "Cedar Lsland". Some of the other middens also contained lesser quantities of oyster shells (*Crassostrea virginica*) and the snail (*Littorina irrorata*). "Cedar Island", with a surface area of 50 by 150 m (Fig. 1, Site 1), extends about 1.0 m above mean sea level and, according to borings, to about 3.5 m below sea level. Most of the mounds were formed during the Tchefuncte and later cultural periods, characterized by pottery production (Table 1). Each mound represents long periods of intermittent occupation and shell accumulation during seasons of food gathering activities. Subsidence, caused mostly by the compaction of the underlying muddy Holocene sediments, clearly affects the mounds. This is shown by occasional, partially drowned oak trees and red cedars in the marsh along mound peripheries. Due to subsidence, some middens may have been completely buried under surface deposits.

Marsh accretion ended between 2,000–1,700 years ago. Termination of the active flow through the protective Mississippi-St. Bernard subdeltas started their disintegration. Renewed coastal erosion increased the adjoining western Mississippi Sound water area and the strength of erosive wave energy on the shores. This initiated the present steady reduction of the south Hancock marshland area.

Table 1. Radiocarbon dates of *Rangia cuneata* from Indian shell mounds, Hancock County salt marshes.

Site (Fig. 1)	Dating laboratory	No. of Analysis	Date (yrs. B.P.)
1 (Cedar Island)	University of Georgia, Geochronology Lab.	UGa-353 UGa-354	2650±70 2900±70
2	Krueger Enterprises	GX2653	1295±90
3	University of Georgia, Geochronology Lab.	UGa-371	2680±75
4	University of Georgia, Geochronology Lab.	UGa-373	2035±65
5	Krueger Enterprises	GX25671	1190±110


5m
10'
1km
1mile
6
5
4
3
2
1
NNE
SSW
Magnolia Ridge
Bayou Caddy
PointClear Island
Cedar Island
Three Oaks Bayou
St. Joseph Point
sea level
5m
0
5
10
15m
Pleistocene land surface

BOTANICAL ASPECTS

Composition and distribution.

The vegetation of the Indian middens contrasts conspicuously with the low profile, homogeneous, and rather monotonous vegetation of the surrounding, extensive salt marshes. A list of plants found on the middens is shown in Table 2. The marshes are composed primarily of *Juncus roemerianus, Spartina alterniflora,* and *Distichlis spicata* (Eleuterius, 1972). The most abundant trees on the middens are the live oak (*Quercus nigra*) and the southern cedar (*Juniperus silicola*). The prevalence of cedar on the largest midden studied is apparently the basis for its name (Cedar Island; USGS Quadrangle, Grand Island Pass, Miss.-La., 1956, photorevised, 1970). Here 16 oaks with diameters at breast height (DBH) ranging from 6–62 cm and about 50 cedars, the largest with a 45 cm DBH. Other common trees found were *Celtis laevigata, Diospyros virginiana, Morus rubra* and *Zanthoxylum clava-herculis.*

The understory of site 1, "Cedar Island" is composed of a mixture of shrubs, primarily *Yucca aloifolia* and herbs. This midden, the most diverse floristically, contained a dense vegetational cover forming an almost impenetrable mass. Other shrubs of frequent occurrence on the top of the middens were: *Ilex vomitoria, Sabal palmetto, Sambucus canadensis, Hypericum hypericoides, Rhus copallina, Erythrina herbacea, Aesculus pavia,* and *Sageretia minutiflora.*

There is no obvious zonation of plants on the midden and the general impression is one of over-crowding. Numerous trees and shrubs lean outward from the mound, this "overhang" shading much adjacent marsh. Many of the shrubs are quite tall and often reach about 6 m. One large oak blown down by winds of Hurricane Camille in the east-central island area in 1969 left a large opening that subsequently was invaded by *Yucca aloifolia.* The southeastern portion of Cedar Island presently is vegetated primarily by small trees, shrubs, and herbs. Stumps indicate that larger trees grew here in the past. The prevailing southeasterly winds apparently have an effect on the vegetation here, sculpturing and damaging the vegetation, as on the eastern ends of the offshore barrier islands (Eleuterius, 1975; Penfound and O'Neil, 1934; Lloyd and Tracey, 1901; and Miller and Jones, 1967). The periphery of the midden contained shrubs that are common on natural levees along the bayous, upland edges of salt marshes and dredged soil. There were *Baccharis halimifolia, Iva frutescens, Borrichia frutescens,* and *Myrica cerifera.*

Figure 2. Geological cross section through Holocene deposits in southern Hancock County marshland. Symbols: 1–clay, mud, sandy mud with *Elphidium-Buliminella* fauna (highest salinity deposits); 2–clay, mud, sandy clay and mud with *Ammonia-Elphidium-Nonion* fauna (reduced salinity); 3–muddy sand, sandy mud, mud with *Ammotium-Haplophragmoides-Miliammina* fauna (low salinity; 4–salt marsh deposits; 5–dune and barrier ridge sands; 6–Indian cultural accumulation (shell mound).

Table 2. Plant species found on Indian middens in Hancock County marshes. Indicator species are those found on shell middens and not in the marshes. They are marked with an asterisk.

Scientific Names	Common Names
TREES	
Celtis laevigata Willd.	Hackberry
Diospyros virginiana L.	Persimmon
**Gleditsia triacanthos* L.	Honey Locust
**Juniperus silicola* (Small) Bailey	Southern Red Cedar
Morus rubra L.	Red Mulberry
Quercus virginiana Miller	Live Oak
**Zanthoxylum clava-herculis* L.	Hercules-Club, Prickly Ash
SHRUBS AND WOODY VINES	
**Aesculus pavia* L.	Red Buckeye
**Ampelopsis arborea* (L.) Koehne	Pepper-Vine
Baccharis halimifolia L.	Groundsel-Tree
Borrichia frutescens (L.) DC.	Sea Ox-eye
**Bumelia lanuginosa* (Michaux) (Pers.)	False Buckthorn, Chittumwood
Campsis radicans (L.) Seemann	Trumpet Vine
**Cissus incisa* (Nutt.) Des Moulins	Marine ivy, Marine vine
Cocculus carolinus (L.) DC.	Coralbeads
**Erythrina herbacea* L.	Coral Bean
Hypericum hypericoides (L.) Crantz	St. Andrew's Cross
Ilex vomitoria Aiton	Yaupon
Iva frutescens L.	Marsh Elder
**Matelea caroliniensis* (Chapman) Woodson	Spiny Pod Milkweed, Climbing or Vining Milkweed
Myrica cerifera L.	Wax Myrtle
Rhus copallina L.	Dwarf or Winged Sumac
Sabal palmetto Lodd. ex Schultes	Cabbage Palmetto
**Sageretia minutiflora* (Michaux) Trel.	Buckthorn
Sambucus canadensis L.	Elderberry
Serenoa repens (Bartram) Small	Saw Palmetto
Similax bona-nox L.	Greenbrier
Wisteria frutescens (L.) Poiret	Wisteria
**Yucca aloifolia* L.	Spanish Bayonet, Yucca
HERBS	
Amaranthus spinosus L.	Thorny Amaranth
Ambrosia artemisiifolia L.	Ragweed
Chaerophyllum tainturieri Hooker	Wild Chervil
Cuscuta pentagona Engelm.	Dodder
**Elymus virginicus* (L.) Britton	Wild Rye grass
Erigeron philadelphicus L.	Daisy Fleabane
Eryngium yuccifolium Michaux	Button Snakeroot
Eupatorium serotinum Michaux	Thoroughwort
Euphorbia maculata L.	Forb
Ipomoea sagittata Cav.	Morning Glory
Lepidium virginicum L.	Poor-mans Pepper
Manisuris rugosa (Nuttall) Kuntze	Joint Grass

Opuntia compressa (Salisbury) Macbride	Prickly Pear
Opuntia stricta Haw.	Prickly Pear
Oxalis dillenii Jacquin	Wood Sorrel, Sheep Sorrel
Panicum amarum Ell.	Bitter Panicum, Beach Grass
Panicum virgatum L.	Switch Grass
Passiflora lutea L.	Passion-flower
Phragmites communis Trinius	Common Reed, Roseo Cane
Physalis angustifolia Nutt.	Ground Cherry
Phytolacca rigida Small	Poke, Pokeberry, Pokeweed
Rhus radicans L.	Poison Ivy
Samolus parviflorus Raf.	Water Pimpernel
Scutellaria ovata Hill	Skullcap
Solidago sempervirens L.	Goldenrod
Spartina cynosuroides (L.) Roth	Hog Cane
Spartina spartinae (Trin) Merrill	Clumped Cord Grass
Specularia perfoliata (L.) A. DC.	Venus Looking-Glass
Stellaria media Cyrillo	Chickweed
Tillandsia usneoides L.	Spanish Moss
Verbesina occidentalis (L.) Walter	Crown Beard
Verbesina virginica L.	Coffee Bean
Vicia ludoviciana Nutt.	Vetch, Deer Pea

There were also many woody vines on the middens such as: *Cissus incisa, Wisteria frutescens, Ampelopsis arborea, Smilax bona-nox Cocculus carolinus, Campsis radicans,* and *Rhus radicans.*

ELEVATION-TIDE RELATIONS. All the other middens are of relatively low profile, and less than one meter in elevation. The diversity of the herbaceous flora is reduced (Fig. 3) with reduced elevation. Those middens only slightly above the surface of the marsh (0.1 m above MLW) had fewer species than those on more elevated areas. No tree species were found below 0.5 m elevation (above MLW). Locally tidal amplitude is about 0.3–0.5 m, thus tidal inundation is probably responsible for the reduction of species.

PLANT-SOIL RELATIONSHIPS. Although the soil on the middens is generally thin, a very black soil layer 4–8 cm thick is often found and is apparently nutritionally rich, judging from the dense vegetation supported. Roots apparently rework soil and shell; shell and soil were found mixed at 8–16 cm depth. Although high phosphorous content of soils is characteristic of upland Indian habitation sites (Diety, 1957; Zeiner, 1946), available phosphorous was generally low, probably due to the relatively high pH of the soil (Hole and Heizer, 1965).

RARE SPECIES. *Sageretia minutiflora*: Mohr (1901) indicated the distribution of *Sageretia minutiflora* as extending from the Carolinas to Florida and west to Mississippi. Recent floristic surveys have failed to locate this species on the coastal plain of Mississippi and Alabama. Radford et al. (1968)

state that it occurs in only two coastal counties of South Carolina and in one in Georgia. Long and Lakela (1971) reported it from Lee County, Florida and Clark (1971) from Mobile Co., Alabama. Specimens were taken from a large shell midden on Dauphin Island. Michael Lelong (personal communication) collected the species from clam shell middens on Little Dauphin Island, Alabama. Shell middens apparently provide the only habitat for this species and this is the first report of its presence in Mississippi.

CULTURED RELATIONSHIPS. Several of the plant species apparently had cultural relationships with prehistoric man since identifiable plant parts have been found in burial mounds (personal communication, Dale Greenwell). Seeds of plants of economic value may have been purposefully introduced at the semi-permanent occupation sites. Cedars may have been propagated because of the fine tinder produced from the bark and used in fire making. Coral bean seeds were probably a source of pigment for paint and used as "bead" ornaments. The fruits of the buckeye are historically known (at least locally, from pioneer days) to make a powerful fish poison. *Manisurus rugosa* consistently found on the more elevated sites is cited by Mangledorf (1974) as an ancestor of modern corn *Zea mays*. There is no known basis for extend-

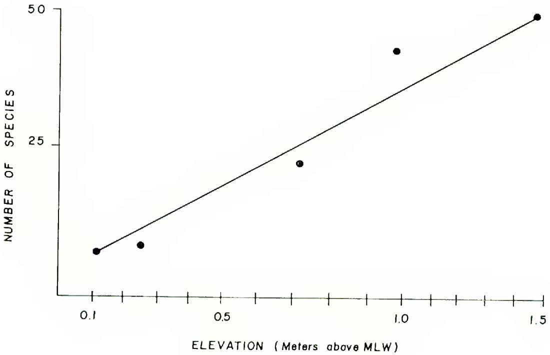


Figure 3. Species diversity in relation to the elevation of Indian clam shell middens in the marshes of Hancock Co., Miss. The number of plant species increased with an increase in elevation. (MLW = mean low water).

ing such speculation to the other species. Chemical work (pharmaceutical and taxonomic) on these species, might be highly rewarding.

CALCIPHILES AS INDICATOR SPECIES. Brown (1938) stated that many species found on Indian mounds and middens that he examined in south Louisiana may be common on alluvial soil elsewhere in that state. He thought that the mound vegetation may have represented a relict. The investigated Hancock marsh mound vegetation, however, can not be relict, since most of the plant species, especially those considered indicators, are calciphiles. Their presence is apparently favored and determined by the large amount of calcium contained in the clam shells. These calciphiles, paradoxically, have not been found on recent deposits of oyster shells, left by European man during the past three centuries.

Indicator species (Table 2) are those species that represent consistent and reliable indicators of the shell deposits on the studied middens. This does not preclude their occurrence elsewhere in other habitats. Several of the indicator species are more frequently found on Indian occupation sites than others. They are also found on occupational burial sites (mounds) on the adjacent terrestrial mainland and may also serve as indicator species for both marsh and terrestrial occupation sites (Eleuterius, unpublished data). These are *Juniperus silicola, Aesculus pavia, Erythrina herbacea*, and *Morus rubra.*

The presence of shell midden within the salt marsh ecosystem provides unique habitats for an unusual flora which increases the diversity of our estuaries. The effects of these specialized, isolated plant communities on the surrounding marsh is of considerable interest for further studies.

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REFERENCES

BROWN, C. A. 1936. The vegetation of the Indian mounds, middens, and marshes in Plaquemines and St. Bernard Parishes. *In* Lower Mississippi River Delta, Reports on the Geology of Plaquemines and St. Bernard Parishes. Louisiana Geol. Surv. Bull. No. 8: 423–440.

———. 1938. The flora of Pleistocene deposits in the western Florida Parishes, West Feliciana Parish and east Baton Rouge Parish, Louisiana. *In* Contributions to the Pleistocene History of the Florida Parishes of Louisiana. Louisiana Geol. Surv. Bull. No. 12: 59–94.

CLARK, R. 1971. Woody plants of Alabama. Ann. of Missouri Bot. Gard. Vol. 58: 99–242.

DIETY, E. F. 1957. Phosphorus accumulation in soil of an Indian habitation site. Amer. Antiquity 22: 405–409.

ELEUTERIUS, L. N. 1972. The marshes of Mississippi. Castanea 37: 153–168.

———. 1975. The plant life of the coastal mainland, associated waters and barrier island of Mississippi with reference to the contribution as a natural resource. *In* Guide Mar. Resources of Mississippi. Sea Grant Publ. p. 84–87.

GAGLIANO, S. M. 1963. A survey of preceramic occupations in portions of south Louisiana and south Mississippi. Florida Anthropologist 16(4): 104–132.

HOLE, F. and R. F. HEIZER. 1965. An introduction to prehistoric archeology. Holt, Rinehard and Winston, N.Y. 497 pp.

LLOYD, F. E. and S. M. TRACY. 1901. The insular flora of Mississippi and Louisiana. Bull. Torrey Bot. Club. 28: 68–101.

LONG, R. and O. LAKELA. 1972. Manual of the flora of tropical Florida. Univ. of Miami Press. Coral Gables, Florida. 692 pp.

MANGLEDORF, P. C. 1974. Corn: Its origin, evolution and improvement. Harvard Univ. Press, Cambridge, Mass. 262 pp.

MILLER, G. J. and S. B. JONES, Jr. 1967. The vascular flora of Ship Island, Mississippi. Castanea 32: 84–99.

MOHR, C. 1901. Plant life in Alabama. Geol. Surv. Alabama. Vol. 6: 921 pp.

OTVOS, E. G., Jr., 1973. Geology of the Mississippi-Alabama coastal area and nearshore zone. Guidebook. New Orleans Geol. Soc. 67 pp.

PENFOUND, W. T. and M. E. O'NEIL. 1934. The vegetation of Cat Island, Mississippi. Ecology 15: 1–16.

RADFORD, A. E., H. E. AHLES, and C. R. BELL. 1968. Manual of the vascular flora of the Carolinas. Univ. of North Carolina Press. 1183 pp.

ZEINER, H. M. 1946. Botanical survey of the Angel Mounds site, Evansville, Indiana. Amer. J. Bot. 33: 83–90.